Nigerian Journal of Paediatrics 1985; 12(1): 11–16

Chemical Composition and Nutritive Values of Some Nigerian School Snacks

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Summary

Ketiku AO and Akinnawo OO. Chemical Composition and Nutritive Values of some Nigerian School Snacks. *Nigerian Journal of Paediatrics,* **1985; 12:11.** Five school snacks namely: *puff–puff*, buns, cakes, cooked beans with sauce and *Fan-ice* were analysed for their protein, minerals, sugar, starch, energy and moisture contents. Their feed efficiency ratios were also determined. *Fan-ice* was highest in moisture (85%) and lowest in energy (57 kcal/100ml). Buns had the highest energy content (325kcals/100g) while cooked beans contained the highest amount of protein (15g/100g). The calcium and iron contents of the snacks ranged from 4–121-mg/100g and from 0.1–0.9mg/100g respectively. On a unit price basis (10k), the cooked beans with sauce, would supply the highest amounts of energy, protein and available carbohydrate while *Fan-ice* would supply the least. While cooked bean with sauce and cake supported growth, consumption of the other snacks resulted in weight loss in experimental animals. Snack food consumption survey among urban school children indicated a preference for *Fan-ice* (49%), buns and *puff–puff* (15% each), cake (13%) and others (8%). It is desirable that children should be guided to purchase the snacks from which optimal nutritional advantage can be obtained.

Introduction

SCHOOL meals can play a large part in providing a uniform nutrient intake especially for children whose home diets are deficient in one or more of the essential nutrients[1]. In some countries such as the United Kingdom, the school meal service is intended to supply half of the daily recommended intake of protein and one third of the energy but unfortunately, this aim is not always achieved[2,3]. McAllister, Hughes and Jones[4] in a survey to assess the nutritional content and uptake of school meals among junior school children aged, 7–11 years, found that the school meal provided an average of 2258kj (540kcal) of energy, 20g of protein, 19g of fat and 15g of sucrose. This represents 25% of total recommended intake of energy and 37% of protein for 9–11 year-old children.

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School meals are particularly important in developing countries. This is due to the trend of low intakes observed with various nutrients especially protein, energy and calcium. Reports from dietary survey indicate that the Nigerian school child is undernourished and this is as a result of consumption of only 70% of the recommended daily intake of energy, 50% of the protein and 47% of the calcium[5]. However, in most Nigerian schools, meals of recommended nutrient content are not provided for the school children. Instead, food hawkers or vendors sell food or snacks during break. The nutritional values of these snacks have not been documented. This paper presents the results of a study aimed at evaluating the nutritive values of different snacks available in schools in an urban centre by estimating their nutrient content, energy value and capacity to support growth in laboratory animals. The paper also reports the result of a consumption survey carried out to find the proportion of children who brought money to school and the type of snacks that they liked to buy.

Materials and Methods

A survey of snacks available from vendors in two primary schools was carried out. One of the schools was non-fee paying while the other was a fee-paying primary school. The schools chosen were in the Sango and Ijokodo areas of Ibadan. The following snacks were chosen because they were readily available, cheap and commonly consumed by the children: cakes, buns, *puff-puff*, *Fan-ice* and cooked beans with sauce. The recipes and methods of preparation of cake, *puff-puff*, buns and cooked beans with sauce were obtained from the food vendors. *Fan-ice* is a commercial product of a dairy factory at Ibadan and information about its ingredient constituents could not be obtained. A bulk purchase of the snack was made and used for chemical analysis and biological evaluation. A food consumption survey was carried out using 800 randomly chosen primary school children (aged, 7–11 years), who were interviewed by means of a questionnaire.

Chemical analysis

Dry matter was determined using an air oven according to the methods of the Association of Official Analytical Chemists (AOAC)[6]. The remaining quantity of buns, cake, *puff-puff* and cooked beans with sauce were dried separately in air oven at 60°C, milled and stored in polythene bags for analysis. The *Fan-ice* samples were stored in the deep freezer and thawed for analysis and for feeding laboratory rats.

Crude fat (ether extract) was also determined using the AOAC method[6]. Total nitrogen was determined by the Kjeldahl's method using selenium and copper catalysts. The crude protein was then obtained by multiplying nitrogen by a factor of 6.25. Available carbohydrate was determined as the sum of starch and sugar components. Sugar was estimated using the phenol-sulphuric acid reagents[7] and starch by the method of McCready, Guggolz and Owens[8]. The energy values of the snacks were determined in the ballistic bomb calorimeter, using benzoic acid as the standard. The mineral elements were estimated by a Perkin—Elmer model 303 atomic absorption spectrophotometer after acid digestion using a mixture of nitric acid, sulphuric acid and perchloric acid.

Biological trials

Forty albino rats were divided into five groups of eight rats each The dried snacks samples were fed to the rats. The *Fan-ice* was thawed and fed to the rats in liquid form. Food and water were given *ad libitum* for 14 days. A record of food intakes and weights of the rats were kept for the calculation of food efficiency ratio. The snacks were not supplemented with any other nutrient.

Results

The proximate chemical composition of the selected school snacks is presented in Table 1. The protein content of the snacks varied from 3.5g/100g in *Fan-ice* to 15.2g/100g in cooked beans with sauce. *Puff-puff*, buns and cake contained similar levels of protein. Buns was richest (15.0g/100g) in ether-extract fat while *Fan-ice* contained negligible amount (0.02g/100g). The fat content of *puff-puff* (8.5g/100g) only contributed 4% of its gross energy of 300 Kcals/100g. Cooked beans with sauce was found to be low in fat indicating the small quantity of vegetable oil used in its preparation. The negligible fat content of *Fan-ice* (0.02g/100g) tended to lend credence to the suggestion that it was prepared from skimmed milk powder and water. The amounts of starch and sugars which constitute available carbohydrates ranged from 11.1/100g in *Fan-ice* to 54/100g in cake. No starch was however, detected in *Fan-ice*, its sugar content of 11.1g/100g was higher than that of cocked beans with sauce but lower than those of other snacks.

Table II shows the amounts of some major and trace elements present in the selected school snacks. Cake was highest in calcium (121mg/100g) while *Fan-ice* contained a negligible amount of 0.04mg/100g. The calcium level in the cake was more than thrice the quantity present in cooked beans with sauce (34mg) and buns (37mg) and double that of *puff-puff* (60mg). All the snacks were found to be poor sources of iron, zinc and copper. Cooked beans with sauce appeared to be exceptionally high in potassium (2,120mg/100g).

In Table III is shown the amounts of nutrients potentially obtainable from ten-kobo worth of the school snacks. The highest amounts of gross energy (178 kcals), protein (12.75g) and available carbohydrates (44.0g) could be obtained from 10k worth (85g) of cooked beans with sauce while the least amounts of energy (49 kcals) and available carbohydrate (8.0g) and the highest quantity of water would be supplied by 10k worth of *Fan-ice*.

Table IV shows the feed efficiency ratios of the school snacks. The results indicate that cooked beans with sauce and cake supported measurable positive growth in laboratory animals while *puff-puff* and *Fan-ice* did not.

TABLE I

Proximate Chemical Composition of School Snacks

Snacks	*Moisture*	*Energy (Kcal/ 100g)*	*Protein*	*Fat*	*Ash*	*Sugar*	*Starch*
Cooked beans with sauce	29.1±0.87	210	15.2±0.46	2.1±0.10	2.1±0.04	2.0±0.6	50±2.5
Puff-puff	34.0±1.02	300	6.1±0.18	8.5±0.42	0.5±0.1	19.1±0.57	29±0.8
Buns	26.2±0.79	325	6.5±0.19	15.0±0.75	0.5±0.1	14.2±0.42	28.0±08
Cake	29.2±0.88	304	6.0±0.18	0.5±0.1	0.5±0.1	20.1±0.60	34±1.0
Fan-ice	85.0±2.56	57	3.5±0.10	0.02	0.02	11.1±0.33	0

Values are in Gm/100Gm edible portion ± standard deviation

TABLE II

Mineral Composition of School Snacks

Snacks	Ca	P	Fe	Zn	Cu	Mg	Mn	K	Na
Cooked beans with sauce	34	59	0.9	0.3	0.0	5.0	0.0	2,120	3.0
Puff-puff	60	15	0.3	0.1	1.0	29	1.0	29	7.0
Buns	37	39	0.3	0.0	1.0	30	0.0	26	7.0
Cake	121	69	0.3	0.0	1.0	30	3.0	220	14
Fan-ice	0.04	—	0.1	0.0	0.0	3.4	1.0	6	1.0

Values are in mg/100Gm edible portion

TABLE III

Relative Nutritive Values of School Snacks

Snacks	*Weight of 10k portion (g)*	*Energy (Kcal)*	*Protein (g)*	*Available Carbohydrate (Starch and Sugars) (g)*	*Fat (g)*
Cooked beans	85	178	12.8	44.0	1.7
Puff-puff	33	99	1.9	16.9	2.5
Buns	32	104	2.0	13.0	4.8
Cake	25	76	1.5	13.5	1.5
Fan-ice	86	49	3.0	8.0	0.0

Food Consumption Survey

Results of the food consumption survey showed that 96% of the children brought money to school to purchase snacks. About half of these children spent 10k each while the other half spent 20k each. The survey also revealed that 49% of the children preferred to buy *Fan-ice* 15% buns, 15% *puff-puff*, 13% would buy cake while other snacks accounted for the remaining 8%.

Discussion

Buns, cakes and *puff-puff* had the highest amount of gross energy while *Fan-ice* had the least energy value. The high amount of available carbohydrates in cooked beans with sauce indicates that this preparation could be a potential source of energy along with its recognised high protein content. The high level of sugars in cakes, buns and *puff-puff* was most likely due to the use of table sugar in their preparation.

TABLE IV

Feed Efficiency Ratios of the School Snacks

Snacks	*Feed Efficiency ratio (Mean ± S.D.)*
Cooked beans with sauce	0.0603 ± 0.01
Cake	0.0469 ± 0.01
Puff-puff	-0.1534 ± 0.02
Fan-ice	-0.866 ± 0.11

The high concentrations of calcium and phosphorus found in cake are of nutritional significance because of the role of these minerals in the proper development of bones and teeth in children. Children should be encouraged to take this snack to supplement the low levels of calcium and phosphorus present in Nigerian traditional diets. Of all the snacks under study, cooked beans with sauce has the highest content of iron (0.9mg/100g). This value is low when compared with 10mg/day which is the daily recommended intake of iron for this group[9].

The amount of nutrients potentially obtainable from 10k worth of each of the snacks shows that the average 7–11 year old child who buys cooked beans with sauce would obtain 178kcal of energy, 12.7g protein, 44.0g of available carbohydrate and 1.7g of fat. These values represent only 8.5% of daily energy requirement, 30.6% of protein and 44% of available carbohydrate for this group of children. The contribution of 10k portion of cake, buns, *puff-puff* and *Fan-ice* to the daily recommended intake of protein and energy of this group of children is therefore, negligible.

Weaning rats fed on buns, *puff-puff* and *Fan-ice* consistently lost weight throughout the trial period resulting in negative feed efficiency ratios. These snacks alone cannot support growth; indeed, the rats fed on buns became emaciated and died before the end of the feeding period. Parents should not encourage their children to rely on these snacks alone as substitutes for nutritionally balanced home diets. The protein in buns and *puff-puff* are mostly vegetable proteins derived from wheat flour. The rats fed on cake and cooked beans with sauce gained weight but the feed efficiency ratio of cooked beans with sauce was higher than that of cake. In addition to vegetable proteins from wheat, cake also contain animal protein from milk and egg used in its preparation. The cooked beans with sauce had high amount of protein together with other nutrients such as calcium, phosphorus and iron, hence it was able to support the growth of rats. The rats fed on *Fan-ice* had the highest negative feed efficiency ratio. It appears that this snack is low in nutrient and since it could not support growth in rats, it should be used as a snack drink alone with other highly nutritious snacks.

There is no statutory obligation on the schools to provide meal or snacks. Such a service is provided normally by food vendors. From the different snacks available, the child is left to choose what to buy. In light of the nutritional information provided on some of these snacks, it appears that the children preferred to buy snacks shown by chemical analysis to have low levels of nutrients and which did not support growth in laboratory rats during biological evaluation of their nutritional value. It is therefore, desirable that children should be guided to purchase the snacks from which optimal nutritional advantage can be obtained.

Acknowledgements

The authors are grateful to Professor A Omololu, University of Ibadan, for providing the funds and facilities for this study and to Mrs AO Fayokun, the headmistress of The Polytechnic Staff School, Ibadan, and Mrs D Sagaya, the proprietress of Cradle Care Institution, Ibadan, for allowing their pupils to participate in the snack food consumption survey.

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